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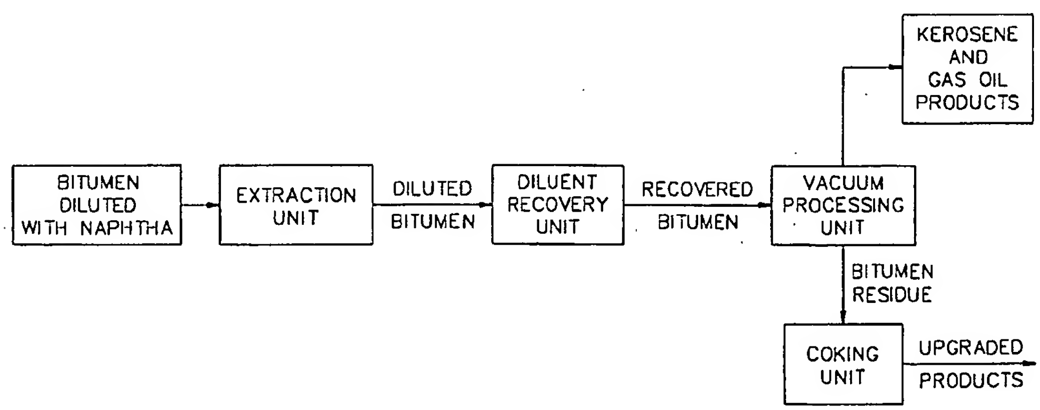
(54) **PROCEDE D'EXTRACTION DES HYDROCARBURES CONTENUS DANS LES SABLES BITUMINEUX**

(54) **PROCESS FOR RECOVERY OF HYDROCARBON PRODUCTS FROM OIL SANDS**



(57) Cette invention concerne un procédé amélioré d'extraction de bitume et d'hydrocarbures légers de sables bitumineux selon lequel l'extrait est distillé sous vide pour donner des hydrocarbures légers tels que kérosène et diesel, le produit de fond bitumineux étant acheminé à une unité de cokéfaction.

(57) Disclosed is an improved process relating to the extraction of bitumen and lighter hydrocarbon compounds from oil sands, wherein the extracted is distilled in a vacuum distillation unit from which the light hydrocarbon products, such as kerosene and gas oil are recovered and wherein the bitumen bottoms are sent to a coking unit.

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ABSTRACT

Disclosed is an improved process relating to the extraction of bitumen and lighter hydrocarbon compounds from oil sands, wherein the extracted is distilled in a vacuum distillation unit from which the light hydrocarbon products, such as kerosene and gas oil are recovered and wherein the bitumen bottoms are sent to a coking unit.

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IMPROVED PROCESS FOR RECOVERY OF HYDROCARBON PRODUCTS FROM OIL SANDS

This invention relates to the extraction process of oil sands wherein bitumen and lighter hydrocarbon compounds are recovered. More particularly, this invention employs a vacuum distillation unit to recover lighter hydrocarbon products from a conventional diluent recovery unit before sending recovered bitumen to a coking unit.

BACKGROUND OF THE INVENTION

The recovery of bitumen from oil sands and further processing of the bitumen to upgraded products is well known and is in commercial practice in the Athabasca oil sands region in the northern province of Alberta, Canada.

Briefly, the production of bitumen entails the mining of the oil sands and the extraction of the bitumen from the sand. In the extraction process a hydrocarbon diluent is required to enhance the recovery, whereby a diluted bitumen product is obtained. This diluted bitumen product is treated in upgrading units where the diluent is recovered in the diluent recovery unit and then recycled back to the extraction process. The recovered bitumen, is sent to the coking unit where the bitumen is upgraded to higher valued products.

BRIEF STATEMENT OF THE INVENTION

This invention modifies the conventional bitumen recovery process by vacuum distilling the bitumen recovered from the diluent recovery unit to recover lighter components such as kerosene and gas oil from the bitumen before sending the bitumen to the coker where it is upgraded to higher valued hydrocarbon products.

DISCUSSION OF PRIOR ART

It is known to use a vacuum processing unit with the refining of crude oil. Such refining methods with crude oil, however, are significantly different from oil sands processing; e.g., refining of crude oil does not employ a solvent diluent and therefore does not have a diluent recovery unit to provide feedstock for a vacuum unit as is used in this invention. Also, the recovery of lighter components such as kerosene and gas oil has not heretofore been recovered in oil sands processing operations which the process of the invention is able to accomplish.

DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the conventional bitumen processing steps from the extraction of diluted bitumen to upgraded products.

Fig. 2 is a block diagram showing the use of a vacuum unit positioned between a diluent recovery unit and a coking unit in the present invention.

Fig. 3 shows in somewhat more detail the processing steps used in the invention.

DETAILED DISCUSSION OF THE INVENTION

Referring first to Fig. 1, it is seen that in the conventional processing of oil sands bitumen obtained from the hot water extraction of the oil sands is diluted with naphtha to enhance recovery in the extraction unit. The resultant diluted bitumen is sent to the diluent recovery unit where the diluent is recovered. The recovered bitumen is then sent to a coking unit for conversion to upgraded products.

Fig. 2 illustrates the process of the invention wherein the bitumen recovered from the diluent recovery unit is subjected to a vacuum distillation which separates the lighter kerosene

component and heavy gas oil (HVGO). The bitumen residue from the vacuum distillation is then sent to the coker unit where upgraded products are obtained.

Referring now to Fig. 3, bitumen from the diluent recovery unit is sent to the Vacuum Processing Unit which comprises a vacuum feed stripper 11, a vacuum heater 12 and a vacuum tower 13. The vacuum feed stripper 11, while not essential, is preferred in order to smooth out any flow fluctuation and to strip off any residual light components before the bitumen is fed to and heated by the vacuum heater 12. The stripped, dry bitumen from the stripper 11 is fed to heater unit 12 providing sensible and latent heat for vacuum distillation. The heater outlet is maintained at about 700 °F and 5 psia. The calculated film temperature in the vacuum heater will be between about 820 °F to about 830 °F and should not exceed this maximum in order to avoid excessive coking. Residence time in the vacuum heater should be less than 30 seconds at 650 °F and higher. When using single or double fired tubes in the vacuum heater the average heat flux should be about 8000 and 12000 Btu/Hr-ft^2, respectively, to keep the peak heat flux as close to average as possible. Outlet temperature of the vacuum heater should be between about 650 °F and about 700 °F.

A plurality of packing beds in the vacuum tower 13, usually about 4 beds, is used to fractionate the kerosene and gas oil. With the use of 4 beds, the first bed (i.e., bottom bed) is kept wet by wash oil and the second and fourth beds are wetted by pump around circuits to remove heat from the vacuum tower and reject it to the incoming bitumen feed from the diluent recovery units. The third bed is wetted by hot pump around as internal reflux to improve

fractionation. The gas oil, as product and pump around, is drawn from the total draw tray below the second bed. The kerosene (LVGO) is drawn from the draw tray below the top bed (i.e., the fourth bed). Exiting the top of the vacuum tower is a somewhat lighter kerosene product. The kerosene and gas oil can be sent to either unifiners to be hydrotreated or to storage tanks for sale as products. Vacuum tower bottoms, which is approximately 50-70% of fresh bitumen feed at 1.5° - 4.3° API, is sent to a coker charge drum. The bottom of the vacuum tower 13 is held at 50 mm Hg to minimize coking and cracking of feed. Approximately 5% of fresh bitumen feed is removed as kerosene and up to 40% as gas oil. The resulting heavier bitumen bottoms, 1.5°-4.3° API, is sent to the existing cokers as feed.

If desired, a recycle facility may be used for recycling some of the bitumen bottoms back to the front end (i.e. the vacuum feed stripper) under startup and low flow conditions.

The flash zone of the vacuum tower will generally operate between about 20 and about 100 mm.of mercury preferably at about 50 mm. Hg . Vacuum tower flash zone termperature will be between about 625 °F and 680 °F, preferably about 673 °F. At these conditions about 60% by weight of the total bitumen feed to the diluent recovery units will leave the vacuum tower bottoms as coker charge. This reduction of fresh bitumen equates to a stream with an API of about 2.5.

The vacuum unit 13 will generally be designed to process the bitumen from the diluent recovery unit at a fresh bitumen charge rate of 125,000 barrel per stream day (BPSD). This results in about 117,000 BPSD of feed to the vacuum unit plus recycled wash oil at approximately 7.0° API, after the steam stripping in the vacuum feed stripper 11. Steam at 50# is used to strip light ends in the stripper 11 and the stripped light ends return back to the diluent recovery unit for further processing.

Due to the operating temperature of the process of the invention being generally higher than temperatures used in conventional procedures without the vacuum unit, corrosion due to naphthenic acids may be enhanced. It is therefore recommended that in order to minimize corrosion, 316 stainless steel with a minimum molybdenum content of 2.5% or 317 stainless steel be used in most services where operating conditions exceed 600 °F.

The process of the invention has several significant advantages which are not obvious from the prior art:

First of all, the coking tendency in the vacuum heater and tower is minimized by the conditions of the process. In addition, the process produces heavy vacuum gas oil having a low content of unwanted metals.

Still another advantage of the process of the invention is the increased yield of liquid from the processed bitumen. In the absence of the vacuum unit of the invention, yield of the liquid is about 83.9%. but with the vacuum unit, yield is increased to about 85.4% which is a very significant improvement, considering the large volumes of bitumen processed.

The process of the invention obtains the advantage of reduced energy consumption over previous methods and is able to employ coking units of reduced size thereby also increasing overall efficiency.

CLAIMS

1. A process for recovering bitumen from oil sands wherein the bitumen is extracted with a hydrocarbon diluent and the extracted bitumen is sent to a coking unit from which upgraded hydrocarbon products are obtained, comprising feeding bitumen from a diluent recovery unit to a vacuum feed stripper (11) to remove light components comprised of any residual diluent, feeding said bitumen from said stripper to a vacuum heater having an outlet temperature of about 700°F and about 5 psia, and a residence time of less than about 30 seconds at about 650°F and higher to raise the bitumen temperature, feeding said heated bitumen to a flash zone-containing vacuum tower to remove kerosene and gas oil liquids, removing bitumen bottoms from said tower and sending the bitumen residue to a coker unit to obtain upgraded products.
2. The process of Claim 1 wherein the flash zone of said vacuum tower operates at between about 20 and about 100 mm of mercury and at a flash zone temperature of between about 625°F and 680°F.
3. The process of Claim 2 wherein the flash zone operates at about 50 mm of mercury and at about 673°F and the bottom of said vacuum tower is maintained at about 50 mm of mercury.

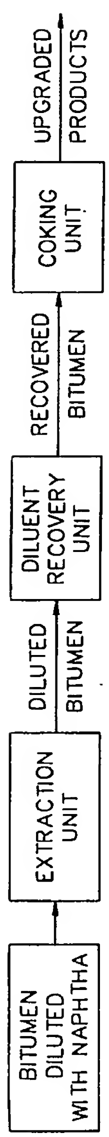

Fig. 1

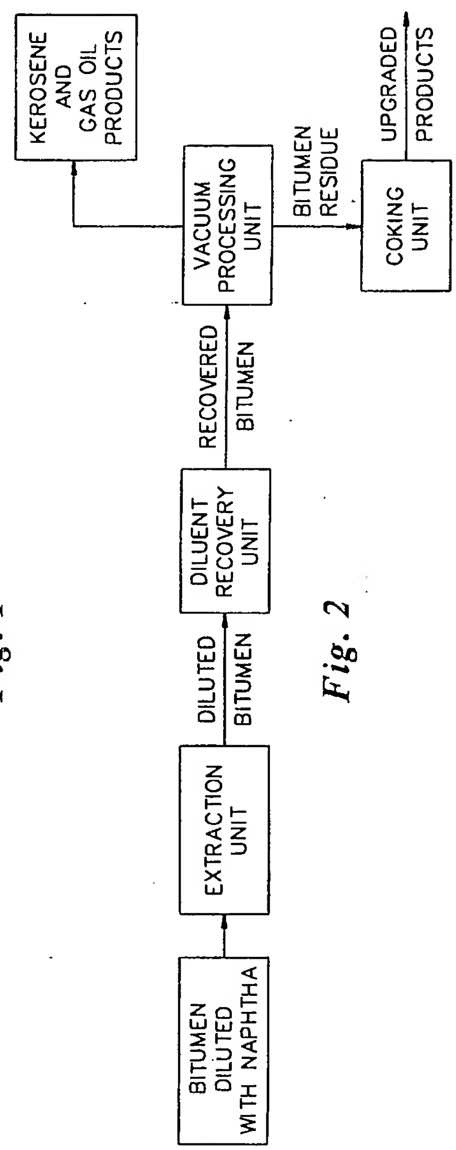

Fig. 2

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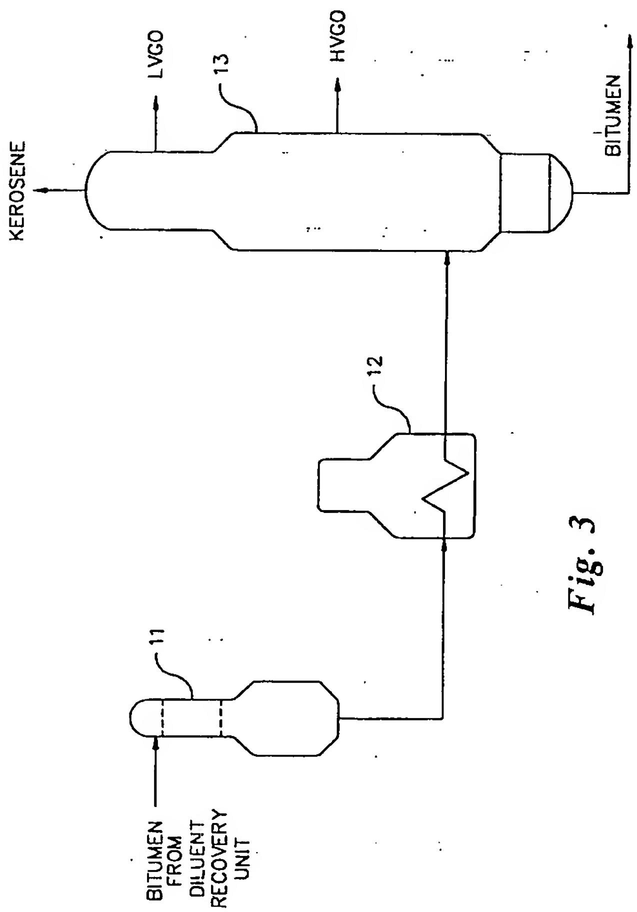

Fig. 3

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